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RFP No. E00004E06

ARC FLASH ANALYSIS FOR WASTEWATER TREATMENT FACILITIES

ADDENDUM NO. 2

Proposers are hereby notified that the document of said Request for Proposals has been amended as hereinafter set forth:

Ref	Page	Location and Description of Change
2-1	Attachment 1	Delete Attachment 1, Scope of Work, in its entirety and replace with the revised Scope of Work, attached as Addendum No. 2, Attachment 1. Changes in the revised Scope of Work are indicated by underlining for additions and strike-through marking for deletions.

This Addendum No. 2 shall form a part of the Request for Proposals document.

Date: February 22, 2006

King County, Washington

Issued by:

Ruth E. Williamson
Contract Specialist

ADDENDUM NO. 2
ATTACHMENT 1
SCOPE OF WORK
RFP NO. E00004E06
ARC FLASH ANALYSIS FOR WASTEWATER TREATMENT FACILITIES

GENERAL

This contract will provide services for short circuit, protective device coordination, and arc flash engineering studies for eighty-two (82) facilities owned and operated by the Wastewater Treatment Division--23 pump stations, 55 regulator stations, two (2) treatment plants, and two (2) office buildings.

COUNTY-PROVIDED INFORMATION

The County will provide to the selected consultant one-line diagrams for all eighty-two facilities in electronic form (.pdf), and short circuit analysis and protection studies and electronic data in etap power station version 3.0 format for West Point and South Treatment Plants. Additional equipment information will be provided as available and necessary.

A sample arc flash warning label and examples of the types of one-line drawings available for each type of facility are provided in Appendix A. For purposes of this RFP, assume that these drawings accurately represent the equipment available at all facilities of the same type.

ANTICIPATED SCHEDULE

The duration of this contract from Notice to Proceed to completion is expected to be 6 months.

SCOPE OF WORK

Task 100 - Project Management

The selected consultant shall organize, manage and coordinate the services required to accomplish the scope of work to assure delivery of products within the specified time. Services may include, but are not limited to, the following:

- 100.1 Project team management and project coordination.
- 100.2 Progress reporting, including description of work accomplished, schedule updates, and percent complete.
- 100.3 Planning, facilitation, and documentation of monthly project meetings.

Potential Deliverables

- Six (6) monthly progress reports, as described above.
- Agendas, minutes, and notes, with revisions as required, for six (6) monthly meetings.

Task 200 - Short Circuit and Protective Device Coordination Study

For each facility, the selected consultant shall perform a study to determine short circuit current at various locations throughout the electrical system, and to determine the correct settings and sizes for fuses, circuit breakers and relays. Both studies shall be performed in accordance with IEEE Standards 141 and 242. The selected consultant shall perform the studies using actual

equipment data and data for protective relay devices from the manufacturer of the switchgear. For purposes of this RFP, assume ten (10) field site visits for engineering staff.

200.1 Perform a short circuit study as follows:

- A. County-provided one-line diagrams, including:
 - 1. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
 - 2. Type designation, current rating, range or adjustment manufacturer's style and catalog transformers.
 - 3. Power, voltage ratings, impedance, primary and secondary connections of all transformers.
 - 4. Nameplate ratings of all motors and generator with their subtransient reactances.
 - 5. Transient reactances of generator and synchronous reactances of generator.
 - 6. Sources of short circuit elements such as utility ties, generators, and induction motors.
 - 7. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.
 - 8. Standby as well as normal switching conditions.
- B. Impedance Diagram:
 - 1. Available MVA or impedance from the utility company.
 - 2. Bus impedance.
 - 3. Transformer and/or reactor impedances.
 - 4. Cable impedances.
 - 5. Equipment impedances.
 - 6. System voltages.
 - 7. Grounding scheme (resistance grounding, solid grounding or no grounding).
- C. Calculations:
 - 1. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
 - 2. Calculate the maximum and minimum ground-fault currents.

200.2 Perform a protective device coordination study, as follows:

- A. Provide an evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.
- B. As a minimum, include the following on 5-cycle, log-log graph paper:
 - 1. Time-current curve for each protective relay or fuse showing graphically that the settings will allow protection and selectively within Industry standards. Identify each curve and specify the tap and time dial setting.
 - 2. Time-current curves for each device to be positioned for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, notify the Project Representative as to the cause.
 - 3. Time-current curves and points for cable and equipment damage.
 - 4. Circuit interrupting, device operating, and interrupting times.
 - 5. Indicate maximum fault values on the graph.
 - 6. Sketch of bus and breaker arrangement.

200.3 Prepare a report summarizing the short circuit and coordination study for all voltage levels of the electrical power system. The "electrical power system" starts at and includes the highest buses of the pump station substation. The report shall also include conclusions or recommendations which may affect the integrity of the electric power distribution system. The short circuit report and coordination study must be stamped

and signed by a Washington State registered professional electrical engineer. At a minimum, the report shall include the following:

- Equipment manufacturer's information used to prepare the study.
- Assumptions made during the study.
- Short circuit calculations listing short circuit levels at each bus.
- Evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.
- Time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.
- Comparison of short circuit duties of each bus to the interrupting capacity of the equipment connected to that bus.
- Recommendations regarding the grounding of medium voltage transformer neutral.

Potential Deliverables

- Short Circuit Study and Protective Device Coordination Reports, as specified above. This deliverable will also become part of the Task 400, Final Report deliverables.

Task 300 - Arc Flash Study

Following the completion of Task 200 for each facility, the selected consultant shall perform an arc flash study to determine the arc flash boundaries, incident energy levels, and the personal protective equipment (PPE) requirements. The study shall be performed in accordance with NFPA 70E, OSHA 29-CFR, Part 1910 Subpart S, and IEEE 1584 Standards. The selected consultant shall perform the studies using actual equipment data and the data from the same manufacturer of protective relay devices as being provided by the switchgear manufacturer. A Washington state registered professional electrical engineer must perform or supervise the performance of arc flash calculations to determine the incident energy, arc flash boundary, and minimum PPE requirements for locations throughout the power system.

300.1 Perform an arc flash study, including but not limited to the following:

- A. For each major part of the electrical power system, determine the following:
 - 1. Flash hazard protection boundary.
 - 2. Limited approach boundary.
 - 3. Restricted approach boundary.
 - 4. Prohibited approach boundary.
 - 5. Incident energy level.
 - 6. PPE hazard/risk category.
 - 7. Type of PPE required.
- B. Produce bus detail sheets that lists the items A.1-7 above and the following additional items:
 - 1. Bus name.
 - 2. Upstream protective device name, type, and settings.
 - 3. Bus line to line voltage.
- C. Produce an arc flash evaluation summary spreadsheet listing the following additional items:
 - 1. Bus name.
 - 2. Upstream protective device name, type, settings.
 - 3. Bus line to line voltage.
 - 4. Bus bolted fault.
 - 5. Protective device bolted fault current.
 - 6. Arcing fault current.
 - 7. Protective device trip/delay time.
 - 8. Breaker opening time.

9. Solidly grounded column.
 10. Equipment type.
 11. Gap.
 12. Arc flash boundary.
 13. Working distance.
 14. Incident energy.
 15. Required protective fire rated clothing type and class.
- D. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels.

300.2 Prepare a report summarizing the arc flash study and conclusions or recommendations which may affect the integrity of the electric power distribution system. The arc flash report must be stamped and signed by a Washington State registered professional electrical engineer. At a minimum, include the following in the report:

- Equipment manufacturer's information used to prepare the study.
- Assumptions made during the study.
- Reduced copy of the one line drawing.
- Arc flash evaluations summary spreadsheet as specified above.
- Bus detail sheets as specified above.

Potential Deliverables

- Arc Flash Report, as specified above. This deliverable will also become part of the Task 400, Final Report deliverables.

Task 400 - Final Report

For each facility, the selected consultant shall produce a final report, summarizing including the studies performed in Tasks 200 and 300. The final comprehensive report will summarize include the short circuit study, protective device coordination study, and the arc flash study, and include all calculations and sample warning labels, in accordance with NFPA 70E, IEEE – 1584, and the National Electric Code (NEC) standards and codes.

400.1 For each facility, create a draft report and submit to King County for review. Each report shall include the following sections:

- Introduction
- Executive Summary
- Short Circuit Study
- One Line Drawings
- Equipment Summary List
- Protective Device Coordination Study
- Time Current Curves
- Settings for Relays & Circuit Breakers
- Manufacturer's Protective Time Current Curves
- Arc Flash Study
- Arc Flash Evaluation Bus Report
- Arc Flash Bus Labels

400.2 Incorporating County comments on the draft reports, produce a final report for each facility.

Potential Deliverables

- Draft and final reports report for each facility, as described above.

- Each final report shall be submitted in hard copy [one (1) set] and electronically in .pdf format on a compact disc.

Task 500 - Label Equipment

For each facility, the selected consultant shall create labels with arc flash safety information and PPE requirements for each major piece of electrical equipment, including, but not limited to: switchgear, switchboards, panelboards, motor control centers, variable frequency drives, disconnects, and transformers. These labels must indicate approach boundaries, incident energy level, and the minimum PPE that is required when servicing the equipment within the arc flash boundary. These warning labels should be color-coded to represent the level of hazard and protective clothing needed. A sample arc flash warning label is shown in Appendix A.

- 500.1 Create sample arc flash warning labels for King County's review and approval.
- 500.2 Produce final arc flash warning labels. Labels shall be printed in color on adhesive backed labels, including the following information at a minimum:
 - Bus name and voltage.
 - Flash hazard protection boundary.
 - Limited approach boundary.
 - Restricted approach boundary.
 - Prohibited approach boundary.
 - Incident energy level.
 - PPE hazard/risk category.
 - Type of PPE required.
- 500.3 Attach arc flash warning labels to the electrical equipment at each facility.

Potential Deliverables

- Sample labels for a typical motor control center and typical panel board.
- Final Arc flash warning labels printed in color on adhesive backed labels, for all electrical equipment required, for eighty-two (82) facilities.
- Documentation of completion of attaching all labels for eighty-two (82) facilities.

Task 600 - Presentations

The selected consultant shall give an informational/training presentation to three (3) separate King County staff audiences, on the hazards of arc flash and the required PPE when working on live electrical equipment.

- 600.1 Plan presentation content, with input from Safety and Facilities staff.
- 600.2 Coordinate and prepare for presentations to County staff at three locations: Westpoint Treatment Plant, South Treatment Plant, and King Street Center.
- 600.3 Lead and facilitate three presentations. Each presentation shall be for up to 30 people for four (4) hours. The focus of the presentation at West Point will be on the West Point Treatment Plant and facilities maintained by West Point staff, and the focus of the presentation at South Plant will be on the South Treatment Plant and facilities maintained by South Plant staff. The presentation at King Street Center will be primarily for engineering staff and will include all facilities.

Potential Deliverables

- Meeting planning minutes.
- Agendas and presentation materials for three (3) presentations for 30 people each.
